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REPUBLIC OF COLOMBIA.

Account of a Journey through the Western
portion of Colombia, showing the possibilities
of the economic development of the districts
visited.

By M. T. DAWE, F.L.S.



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This map illustrates the Pacific region of Colombia, highlighting the coastline and major urban centers. The Pacific Ocean is on the left, with the Caribbean Sea to the north. The Andean mountain ranges are depicted in the interior. Major cities shown include Bogotá, Medellín, Cali, and Barranquilla. The map also shows the Andean mountain ranges and the Caribbean Sea to the north.

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MAP SHOWING THE ROUTE FOLLOWED (IN RED INK) BY MR. M. T. DAWE, F.L.S., IN HIS JOURNEY FROM TOLIMA
TO THE PACIFIC COAST THROUGH THE DEPARTMENTS OF CALDAS AND EL VALLE.

An Account of a Journey from Tolima to the Pacific Coast, through the Departments of Caldas and El Valle (*Republic of Colombia*)

By M. T. DAWE, F.L.S.

THE AGRICULTURAL CONDITIONS AND POSSIBILITIES.

The following is an account of a journey, undertaken by the writer in his capacity as Agricultural Adviser to the Ministry of Agriculture and Commerce, on behalf of the Government of Colombia in the interests of agriculture and commerce.

Route.

The route followed was from San Lorenzo, in the Magdalena valley, over the Central Cordillera, by way of the snow-covered mountains of Ruiz to Manizales: thence to the northern part of Caldas as far as Aguadas, returning through the western part of the Department by way of Marmato, Riosucio and Belacazar to La Virginia, a port on the Cauca river; thence to the Quindío by way of Pereira, Salento and Armenia over the Cordillera as far as Perales in the municipality of San Miguel, returning via Armenia and Montenegro to Cartago. From Cartago by way of the Cauca river to Cali, thence by the Pacific railway to the Coast of Buenaventura, returning to Cali; thence overland through the important valley of the Cauca by way of Palmira, Buga and Bugalagrande to Cartago. From Cartago, returning via Filadelfia and Santa Rosa de Cabal to Manizales; thence crossing the Central Cordillera, for the third time, by way of Solidad, returning to the Magdalena valley at Mariquita on the La Dorada railway.

Ascending the Cordillera Central.

We set out from San Lorenzo on October 19th, 1918, our first object being to journey to the *páramos*¹ and snow-covered mountains of Ruiz, *en route* to Manizales, the capital of Caldas. I was accompanied by Señor Pablo E. Aza, as Secretary, and we took an *arrecaro*² and cook, and in addition to our riding animals, five pack animals to convey our tent, equipment and collecting material.

Leaving the sympathetic and progressive little town of San Lorenzo behind, we commenced the ascent of the Magdalena slope of the Central Cordillera. The lower part, or foot hills of the range, is of a somewhat sterile and stony character, as is the case with the Cordilleras in many other parts of Colombia. The vegetation is scanty, the arboreal vegetation limited to small trees, there being few large trees except in the watered valleys and ravines or *quebradas*. After, however, climbing slowly for four hours, we found ourselves in better lands, and at dusk we reached the *posada*³ known as Estrella, where we passed the night. This is the commencement of the coffee zone, and the poor stony lands of the foothills of the Cordillera here are replaced by lands of excellent fertility, as is amply demonstrated by the luxuriance of the vegetation and the robust and healthy growth of the cultivated crops.

Coffee growing in this locality is in the hands of small planters, and signs are not wanting that this will develop into a very important coffee producing region in the near future.

The next day we left Estrella at 10 a.m., for Libano, our departure having been delayed by torrential rains, which made our climb up the mountain side very tedious and slow, but we reached Libano shortly after noon. The road from Estrella first crosses a deep valley, and the path winds down the precipitous slopes and then takes a winding course up the no less steep ascent on the opposite side. This is a most picturesque region, and one fed on beautiful scenes of sub-tropical vegetation of which the tall, graceful and slender palms, are not the least conspicuous, reminding one of similar scenery of the hill country in the interior of the island of Ceylon. The whole of this morning's journey was through the coffee zone; coffee-growing being the principal cultivation of the region, forming the backbone of the trade and commerce of Libano.

Libano and its Agricultural Importance.

The town of Libano is a busy and growing centre, and has a delightful temperate climate. The principal crops of the municipality are: coffee, maize, beans, wheat, potatoes and cacao; though rice, tobacco, plantains, barley, sugar-cane, onions and peas are also grown to a considerable extent. Maize leads the way in production of quantity, the annual crop being about 100,000 sacks; coffee leads the way in the value of the annual crop, it amounts to about 80,000 sacks; the annual production of beans amounts to about 50,000; potatoes, 40,000; wheat, 3,000; and cacao, 350 sacks.

Industries.

Coal and copper are found in the region, but the deposits are not exploited. There are several coffee-mills for the hulling and cleaning of the bean; flour mills; one sack-making establishment for the utilization of *fique*¹ fibre; four distilleries for the manufacture of the national beverage, "aguardiente"; four factories for the manufacture of aerated waters, kola and beer; and two tanneries.

The Timber Resources of the Central Zone of the Cordillera.

From Libano we proceeded to Murillo, a little town in the cloud-forest region, where the principal occupations are those of potato and wheat-growing and cattle-farming. Murillo is a dependency of the municipality of Libano.

The central part of the Cordillera contains a good deal of forest; there is little doubt that at one time it was completely covered with forest, but large areas have been cleared in the lower part of the central zone for the cultivation of coffee, maize, &c., and in the higher part of the central zone for the cultivation of potatoes, wheat, barley, and the laying down of pasture lands. On the journey from Libano up the mountain we noticed that a good deal of this clearing has been the work of recent years.

Before reaching Murillo we passed through forests composed entirely of Colombian oak or *roble* (*Quercus* sp.).

¹ Moors.

² Muleteer.

³ Rest-house.

¹ *Fourcroya* spp.

Murillo itself is surrounded by forest land and might be termed the village amongst pines, since two of the principal trees in its immediate vicinity are the *pino* (*Juniperus* sp.) and *chaquero* (*Podocarpus* sp.); both trees of the conifer family, much valued for their useful timbers.

One of the points apparent in journeying up the mountain is the enormous resources there are in timber, in its wonderful variety of classes; embracing excellent qualities for construction as well as for cabinet and even fancy work. There are cedars (*Cedrela* spp.) of various classes; *comino* and *comino crespo* (*Aniba perulilis*), the latter a very handsome and valuable timber for cabinet work, immune to insect attacks and the former used for sleepers on the Medellin railway; *nogal* or walnut (*Cedrela nogal*); *roble*, or oak (*Quercus* sp.), one variety yields a beautifully marked timber; *pino* (*Juniperus* sp.);

(*nuche*) and ticks, &c., applied externally; and for skin affections taken internally in the form of pills. The fat is sold in the local markets at about forty cents. per pound. The trees are said to give two crops of seeds a year, and from one crop of a mature healthy tree about fifteen pounds of the fat can be extracted; small trees yield very much less. As this product is very widely applied in this country as a domestic remedy for cattle parasites, and has a considerable reputation, it seems that its medicinal value should be scientifically investigated. I therefore sent samples of the nuts and butter to the United States and to England for technical examination and investigation. Should the fat prove to have the medicinal properties attributed to it, it is not unlikely that it may form a new article of export for the manufacture of an insecticide or other medicinal preparation.



FIG. I.—THE SNOW-COVERED MOUNT RUIZ.

chaquero (*Podocarpus* sp.); *arenillo*, *quimulá*, *mario*, *laurel*, *aceituno*, *fresno*, *aguacatillo*, *vilivil*, *chilco*, *cacao*, *diomate*, *olobo*, *graniso*, &c., &c.

Otobo.

This tree is a very interesting one, not so much for the value of its timber, which is rather soft and used principally for ceiling-boards, but for its seeds, from which a medicinal butter or fat is extracted. The tree is known botanically as *Myristica obo*, and it belongs to the same genus as the nutmeg of commerce. The tree is tall, with outspreading horizontal branches collected towards the top of the tree; it resembles in habit the nutmeg tree; and also the "false nutmeg" of Central Africa, *Pycnanthus Schweinfurthii*. The seeds are a little larger than those of the true nutmeg and round in shape; like the nutmeg it is surrounded by a mace, though of paler colour. From the seeds is extracted the butter or fat by boiling and pressing. This is much prized as a remedy for warbles

The Ascent up the Snow-Covered Mountains of Ruiz.

From Murillo, on a clear day, one gets an excellent view of the snow-covered mountains of Ruiz, and from this village we decided to make our ascent to the glaciers. We therefore set out on October 23rd, accompanied by Don Roberto Londoño and Don Bernardo Izquierdo, the former being our *vaqueano*,¹ having made the excursion before. Leaving the "village of pines" behind us, we commenced the ascent. We first passed through forest-clad lands, broken only by the clearings that have been made for potato fields and grazing lands. The standing stumps of the trees, however, indicate that the conversion of forest lands to potato fields and pastures is a work that has been accomplished in recent years. These forests are heavily stocked with trees, and the labour necessary to

¹ Guide.

convert them into agricultural land is very considerable. Some efficient means of removing the tree stumps is badly needed; no doubt the stump-pulling appliances and devices used in Australia, South Africa, and other countries might be advantageously used in this region; especially for the removal of the stumps and roots of smaller trees. Both my companions, Señores Londoño and Izquierdo, are owners of very large properties in this region, and both have done very important work in the conversion of forest to agricultural land and the development of agriculture in the region.

Continuing our ascent, we passed through beautiful forest-clad valleys, well watered with clear streams from the mountains. Here and there on the roadside we noticed giant blackberries; wild *curubas* (*Tacsonia* sp.) with handsome flowers and a beautiful climbing plant peculiar to this country, a species of *Mutisia*. A handsome scarlet flowering *Begonia*, *Bomareas* of many varieties with their attractive globose heads of flowers. *Fuchsias*, and *Thibaudias*, were also among the attractive plants in this region.

We soon passed through the timbered lands, which are gradually replaced by bush peculiar to the higher reaches of these Cordilleras. One of the plants worth mentioning is a handsome *Berberis*, a shrub laden profusely with golden flowers, known locally as *España de Oro*. Here the scenery is very beautiful, pretty cascades giving variety to it. About midday we reached the last habitation on the Magdalena side on the mountain range at a point known as Boqueroncito. This forms the limit of the bush land and the dividing point between it and the open páramos.

Here also the cultivation of the potato comes to an end, and the potato fields are fenced off from the uncultivated páramos by a wire fence, as if the rude and sudden transition from the cultivated to the uncultivated required an artificial boundary. At Boqueroncito we decided to have lunch before proceeding to the snows, and the occupants of the hut, Pedro and his wife, very kindly assisted us in its preparation. After having lunched we passed out through Pedro's gate into the land of the frailejón¹ (*Espeletia* sp.) and continued on our way through the páramos to the glaciers.

One of the first impressions of the páramos of Ruiz was its general similarity to the páramos of the Cordillera Oriental and of the Sierra Nevada of Santa Marta. There are the same wiry grasses, the same groves of frailejones,

the same carpet of *Alchemilla*; but a closer investigation reveals differences. The frailejón is a distinct species to that found on the Cordillera Oriental or the Sierra Nevada of Santa Marta, and there are many plants which I had not found on those mountain ranges. There is, however, notwithstanding, a similar general effect; for many of the principal genera are represented on each of the Cordilleras, though by different species or allied forms.

About an hour's journey from Boqueroncito, we came across one of the most beautiful and interesting plants of the mountain. It is a species of *Lupinus* with an erect solitary spike of flowers, which reminds one of the stately tree lobelias of the mountains of Central Africa. This lupine is covered with a dense coat of white woolly hairs, not only the leaves but the flower spike, and could it be cultivated, would prove a most interesting novelty among plant lovers. Seeds of it have been sent to the Royal Botanic Gardens at Kew, and to the New York Botanical Gardens, to ascertain if it can be grown under artificial conditions.

At about 5 o'clock in the evening we sought a suitable place to pitch our tent, and prepare ourselves for the cold night we were to pass. After some little search we found a rock shelter, under which we pitched our tent, and settled down to prepare our dinner before retiring to rest.

On passing through Libano, I had the good fortune to meet Don Antonio Izquierdo, a distinguished and progressive agriculturist of Bogotá, who owns the important estate of San Ignacio at Murillo. He drew my attention to the possible utilisation of the woolly floss which covers the frailejón, in substitution of blankets. This night we collected a large number of frailejones and made a practical test of it. We retain no doubt about its warmth-giving properties, but it also emits a strong turpentine smell, which I calculate

would repel any invasion of the flea tribe so frequent in the colder parts of Colombia.

Our friend, Don Roberto, was the first to arouse us in the morning and insist on our early departure for the glaciers, for the morning, though clear, might soon be shrouded in mist and our view of the glaciers obscured indefinitely. Having collected our shivering horses we proceeded on foot, as the first part was too steep to ride, being a land-slide from one of the ridges. On gaining the top, we rode around one of the peaks of the mountain, passing over land-slides or drifts composed of shale or sand, having all this time a splendid view of the Nevada



FIG. II.—A PRETTY CASCADE ON MOUNT RUIZ.

¹ A composite shrub common on high páramos.

or snow-covered mountains. From the point we left in the morning, the vegetation gradually became sparser and the growth smaller. The *frailejón* disappeared altogether, to be replaced however by the *frailejón blanco*,¹ one of the most fascinating plants of the upper reaches. It is covered with an exceedingly dense coat of white woolly hairs; I know of no plant so well protected against the cold as this most remarkable plant. As soon, however, as snow is reached, the plants become scarcer, until finally there is nothing save a few lichens. One of the highest of the flowering plants is a *Cruciferous* species, evidently an *Arabis*, this being a white and yellow variety. Another interesting plant of the higher reaches is a shrubby *Lycopodiad* of erect habit, a representative of one of the earlier forms of vegetation.

As we neared the glaciers, we noticed that the air was laden with a strong smell of sulphur, though we did not ascertain whether it came from a fissure in the earth or from a sulphur spring. We reached on horseback the snow line, and here we dismounted and climbed as far as it was possible to do so without climbing apparatus up the glacier to about 5,500 metres above the sea-level. Here and there were deep crevices in the great mountain of ice, down which we had to be careful not to slip. At last we reached a cleft on the glacier, from which we were able to gaze down on the little town of Murillo, and obtain a fine view of the country side. This vision, however, was only for a few minutes, for the rolling mists coming up over the mountain soon obscured our view, and indicated to us that it was time to descend and regain our track.

We retraced our steps to where we had left our horses, which being *calentanos*² and not accustomed to the cold, to say nothing of the blinding vision of the snow-covered mountain, were glad enough to withdraw from the strange scene.

Many have come a long distance to make this excursion, and have not even been able to get a glimpse of the glaciers. From the moment however we rounded the first pinnacle we obtained a clear view of the whole snow-covered range, and it remained clear until we gained the cleft from which we obtained the view of Murillo, when the mists rolled up the mountain. Had we been half-an-hour later we should have seen nothing. We therefore congratulated ourselves on our good fortune, and having accomplished our object, returned that same day to Murillo, where we arranged our collections and made preparations for the journey across the *páramo* to Manizales.

Need of Transport Cable.

Before continuing the description of our journey, I would like to draw special attention to the fertility of the central zone of the Magdalena slope of this Cordillera, and to the possibilities of developing this important region. I have already remarked on the importance of the lower-central part of this zone in respect of coffee cultivation, a region capable of very considerable expansion in this and other agricultural industries. The upper-central part of this zone, however, has a cold climate, and the soil superior to many other similar regions of Colombia; it is a region where white people can settle and live. There are few parts in Colombia where such fine crops of potatoes are produced; already it has assumed a crop of considerable importance, but there is room for expansion. Cattle thrive wonderfully well, and I was struck with the rich clover pastures, pasture which produces a milk exceedingly rich in cream and butter. Here is a region capable of great developments in potato, wheat and barley growing and cattle farming. The time is probably not far distant when this region will require a transport cable

to carry its agricultural produce to the Magdalena valley, and to bring up its trade goods and machinery. Such a cable would do much in expanding the potato industry. It is well known that potatoes grown in the interior of the country have very little keeping qualities at the Coast and in the hot country. This is due very largely to the fact that the potatoes, conveyed from the highlands on mule-back, become bruised by the constant jarring caused on the road, and so become readily attacked by diseases which rapidly spread. Potatoes carefully packed in barrels or boxes and conveyed by cable to San Lorenzo, would not be so bruised and would stand a better chance of competing with the imported American potatoes at the Coast. The system of transport by cable is one that ought to be more generally adopted in this country, especially in the mountainous regions, for the conveyance of produce to the main export routes. As I journeyed up this mountain slope, and passed enormous and continuous caravans of pack-mules laden with produce, I thought what a wonderful increase of production could be brought about if this vast force of men and mules employed in transport was applied instead to the cultivation and development of the land.

In Ceylon, many an individual tea or rubber estate has its own cable for the transport of the tea or rubber, &c., from one part of the estate to another. The cheap transport of produce to the main export routes is one of the most important economic problems of this country, and a problem which should receive the serious attention of the departmental and municipal administrations of the country. The important Mariquita-Manizales cable, or rather the section of it that is completed, is already demonstrating the value of such a method of transport on these Cordilleras.

Crossing the Páramo of Ruiz.

On October 25th, we set out from Murillo with the intention of spending the night at Boqueroncito, so that we could make an early start the next morning to cross this much-dreaded *páramo*. We took with us a *vaqueano* and animals accustomed to the journey. We found Pedro, the owner of the little house at Boqueroncito who had accompanied us up the mountain, was away at Manizales. His genial wife however accorded us a room, and assisted our cook in the preparation of our evening meal. We found Boqueroncito so cold that we were obliged to seek the warmth of the kitchen fire; at 7 a.m. on the following morning our thermometer registered 5° C. From the kitchen door we had a magnificent view of the *Nevada*. Neither on our previous journey up, nor on our return journey down, did we see anything of the *Nevada* from this point. We hoped that Pedro would have returned that evening to accompany us across the *páramo* in the morning, but shortly after sunset his wife looked out across the *páramo* and then with an air of disappointment told us that Pedro would not return that night.

In spite of our intention to start early, the *arreero* found excuses for delay and it was nearly 9 o'clock before we left Boqueroncito. We did not accompany our caravan, having an additional *vaqueano*, who took us a shorter route; this we regretted having taken after sinking down with our horses in the morass and bogs several times, and finding difficulty in extricating ourselves. We journeyed on for three hours before we regained the main track, and from the absence of fresh footprints we gathered that our caravan had not passed. We waited at a lovely cascade for nearly two hours, watching the mists roll up the mountain and pass over, before sighting our caravan. Then we continued our journey to await them at a rock shelter for lunch. To reach this shelter

¹ White *frailejón*.
= *Cuscuta*

² Hot country horses.

we had to cross a huge rift in the mountain slope, and descend down an indescribable track in order to ascend an equally bad one on the other side. We gained the rock shelter and kindled a fire, and wondered how the pack animals with their cumbersome loads would manage to cross this rift, beset with boulders and huge rocks. Soon however we heard the voices of the *arrearos*, and from their forcible language we knew that they were having an awful time goading the animals up this difficult trail. We did not allow them to stop here, as we knew that we were a long way off from Termales, the *posada* which was our objective on the other side of the mountain. From this point we had a further steep climb to pass the last ridge which has to be crossed before the descent commences. This we reached at about 3 p.m., and here again we had an excellent view of the *Nevada*. Gaining the summit of this ridge we met with a very strong, cold breeze, and passing over the sand drifts known as Arenales, we soon found ourselves in *páramos* of a distinct class. Here we observed that the *frailejón* was less in evidence, and that the *páramos* formed grazing lands of a superior quality to anything we had seen on the other side. We relieved our caravan of the unburdened animals they were driving, in order that they might make more headway, and drove them along in front of us. We hastened on towards Termales, recalling the story we

us over the hot springs to the kitchen door, where a welcome fire was burning.

Our thoughts then turned to our caravan, but we knew that our men could not reach Termales that night, as we had left them a long way behind. After drying ourselves at the fire, and partaking of a scanty meal, we retired for the night; not, however, to sleep, as our blankets were on the *páramo*, and we were obliged to pass the night on a bare wooden bedstead, and the intense cold was only varied by the constant dripping of icy cold water, which condensed on the wooden ceiling above.

The caravan did not turn up till nearly noon on the following day; the men, mules and loads were covered in mud and told the tale of suffering that they had gone through. They had been overtaken in a fog and were obliged to spend the night in the open *páramo* without any shelter whatever. I subsequently discovered that the small supply of liquor which we carried as medicinal luxuries had served to impart bodily heat and protect them somewhat from the penetrating cold. Even an *arrearero* does not hesitate, when in a difficult position, to apply such remedies as may be at hand, especially if they be the property of his *patron*! The mules had wandered back on the trail during the night, and much time had been lost in overtaking them. We saw, of course, at a glance that there was no hope of proceeding that day to



FIG. III.—TERMALES.

had been told of a person who got benighted on the *páramo* with his son, and who, fearing death from exposure, made his will in the night. We pushed on over a terrible road, rain and fog set in, and we lost the horses we were driving. We however continued, not knowing whither we were going, but trusting to our horses for knowledge of the route. At about 7 p.m., we found we were getting near Termales, from the smell of sulphur which the hot springs emitted. After much shouting, the owner of the *posada* came out, and lighted

Manizales; there was, however, no meat in the larder at Termales, but the purchase of a sheep overcame all immediate difficulties.

We spent the day collecting plants and botanical material, there being much of interest in the neighbourhood. We further took the precaution of engaging one of the bedrooms situated over the hot springs, in order to avoid a repetition of the previous night's experience of the cold bedroom and dripping roof. The whole of this

¹ Master.

day we were enveloped in a dense fog, and the temperature, from seven in the morning to seven in the evening, did not vary a fraction from six degrees centigrade.

The *posada* of Termales is provided with a series of hot baths, to which the water is laid on direct from the hot springs. Many people visit these baths for treatment. The water is highly charged with sulphur and it is also strongly acid. It no doubt possesses valuable medicinal properties for the treatment of certain complaints and diseases.

THE DEPARTMENT OF CALDAS.

Arrival at Manizales.

On the morning of the 29th the mists had lifted, and we were able to get a good view of Manizales in the distance. After taking views of these interesting springs, we left Termales and commenced the descent down the Cordillera. This side of the mountain slope is covered with forest land, the lower part containing a good number of the *Ceroxylon* or wax palm. Once clear of the forest area we got an excellent view of the Manizales district, and the panorama of wide grassy expanses formed a welcome contrast to the wild *páramos* through which we had passed. Indeed, the view before us reminded me of certain pastoral regions of Europe. Only when one neared the open lands, and came into closer view of the *Ceroxylon* palms and other strange features of the vegetation, did the illusion disappear.

Early that afternoon we reached Manizales, a picturesque little city, with quaint narrow streets, situated on a hill side. Many a curious tale this city could tell of the difficulties it has found to establish itself; hills have been removed and valleys have been filled, in order to extend this or that *calle*¹ or *carrera*.² Lagoons or small lakes, over which once plied small canoes, have disappeared before the builders' lust. And now stands the capital of

¹ Street.

² Avenue.

the Department of Caldas, with a magnificent cathedral and public buildings, and many beautiful private houses; the latter are, however, frequently marred by the almost invariable custom of devoting the ground floor to a shop. Here we halted several days in order to rest our animals, and make methodical preparations for the tour through the Department. We found the Government officials most obliging and helpful, especially the Governor, Dr. Pompilio Gutiérrez, and his indefatigable Secretary, Dr. Gerardo Arias Mejía, who arranged Committees in Manizales and in the provincial towns to assist us in our mission.

Manizales.

The city of Manizales was founded in 1849, it is situated at about 2,140 metres above sea-level on a hill overlooking the plateau of Ruiz, and has an average temperature of about 16 degrees centigrade. The population of the municipality, according to the census of 1918, numbers 41,146.

Industries and Commerce.

There are several important banks established in the city, and other respectable banking establishments represented. There are also a considerable number of import and export houses.

According to official publications, there are 6 *trilladoras* or coffee cleaning mills; a flour mill; 5 tanneries; 4 chocolate factories; and 80 sugar-cane mills, of which 14 are moved by water power and 66 by animal power, which produce in the year about 3,400,000 kilos of crude brown sugar or *panela*. There are also two electric plants for the production of light, heat and power. One is the property of the municipality, and has water power capable of producing 1,500 horse power, though the plant operating produces only 400 h.p.

In addition, there are manufacturing establishments for the following articles: candles, nails, coffee, matches, cloth, soap, cigars, cigarettes, cloth hats, biscuits, aerated waters, boots, also saw and planing mills.

Manizales is a progressive town, being the central market for minerals and agricultural produce of a considerable region. It is not however connected by rail or water with any other centre of commerce. When, however, the transport cable now in construction connects Manizales with the Magdalena valley, and the Caldas Railway reaches its terminus, Manizales will be connected with the central trade artery of the Republic and also the Pacific Coast, which should bring a new era of prosperity to the whole Department and its capital.

Dairy Farming.

On this great plateau there are magnificent cattle lands, especially suitable for dairy farming. There is a considerable demand for dairy produce in Manizales, and although Normandy cattle have been imported with good results, the fine dairy breeds, Jersey



FIG. IV.—GRAZING LANDS NEAR MANIZALES.
The Bull in the Foreground is a Cross with an Imported Breed.



FIG. V.—CATTLE ON A HACIENDA NEAR MANIZALES.

and Ayrshire, would probably give even better results for dairy purposes, crossed with the native animals. The Jersey is a breed from the island of the same name, and the cows being good milkers, it is one of the most profitable breeds for the production of butter. The latter is the famous milking breed of Scotland, where their produce is chiefly utilised for cheese making.

Cera de Laurel or Myrtle Wax.

I noticed the *Laurel*, or *Olivo*, as the shrub is also termed locally, occurs in abundance in the ravines in the environs of Manizales. The accompanying photograph is of a forest of these laurel trees, or *oliveras*, as they are here designated. The *cera de laurel* or myrtle wax of



FIG. VI.—MYRTLE-WAX TREES NEAR MANIZALES.

commerce, is the product of this tree. The wax surrounds the berries, and it is obtained by submerging the berries in a fibre bag in boiling water and subsequently pressing. The mixture of wax and water is then run into cold water, when the wax solidifies. It is afterwards collected and re-melted into moulds of the size and shape desired. A sample of this wax has been forwarded to the Imperial Institute for examination, and the following is a report which has been received on the subject :

"The sample forwarded to the Imperial Institute consisted of a yellowish-buff coloured wax which had a peculiar odour similar to that of myrtle wax from South Africa ('Cape berry wax').

"The material as received contained 0.31 per cent. of moisture, and only 0.17 per cent. of dirt. It yielded 0.06 per cent. of ash.

"The wax was submitted to chemical examination with the following results, which are shown in comparison with corresponding figures for a sample of South African Myrtle wax examined at the Institute and those recorded for commercial myrtle wax :

	Present sample from Colombia	South African myrtle wax	Commercial myrtle wax
Melting point ...	45° C. ...	40.5° C. ...	40° C. to 48° C.
Solidifying point of fatty acids	46.4° C. ...	— ...	46° C.
Acid value ¹ ...	21.7 ...	4.1 ...	3 to 30.7
Saponification value ¹	216.7 ...	211.1 ...	205 to 217
Iodine value (per cent.)	1.03 ...	1.06 ...	1.95 to 3.9
Unsaponifiable matter (per cent.)	0.4 ...	— ...	2.5

"From these results it will be seen that this myrtle wax from Colombia possesses the general characteristics of commercial myrtle wax, of which *Myrica arguta* is stated to be one of the usual sources in South America.

"A firm of importers in London stated that consignments of this wax would probably be worth about £100 to £110 per ton (May, 1918), compared with a pre-war price of about £40 to £45 per ton. Owing to its low melting point, this wax could not be used for all the purposes of Carnauba wax, for which there is a very large demand at present, especially for the manufacture of cartons to be used as food containers."

Arboloco.²

This is a small tree which is common in the volcanic region of Manizales. It is known botanically as *Montanoa Moritziana*, C.H.S., and belongs to the natural order *Compositae*, a family more noted for its beautiful garden flowers than for useful timbers. It is an erect tree growing up to about 10 metres in height. Its bole is hollow, but the wood is very durable and is much used for house building, especially as flooring beams. The wood is also prized for the manufacture of billiard cues. It is said that the tree is peculiar to the volcanic region around Manizales, but I have also seen it on the Cordillera Oriental at a similar altitude. This tree might however with advantage be planted in other parts of Colombia, where the lands are suitable, and where the temperature is about 16° C., as the tree is of rapid growth and the timber very suitable for the construction of small houses, &c.

Manizales to the North of Caldas.

We left Manizales on November 4th in the early afternoon and reached Neira at dusk. The road for the first part was along a track half way up the hill slope, from which we had an excellent view of the valley. The hill sides are extensively cultivated and the region fairly well populated. The *arboloco*, to which I have previously

referred, is the most striking feature of the vegetation, forming little forests here and there.

Neira is situated about 19 kilometres from Manizales, at an altitude of 1,941 metres, and has a temperature (average) of about 19° C. It is a very important region for cattle, and produces a good deal of agricultural produce, for which it finds a ready sale at Manizales. Gold and silver are found on the Cordillera Central, and the forests of the mountains contain a great variety of useful and valuable timbers. Salt springs are also found.

The town has an electric light plant ; two *trilladoras* for coffee ; one tannery ; also three sugar-mills worked by power and 106 wooden sugar-mills, moved by animal power, which produces a total of about 65,930 *arrobas*¹ of *panela*.

From Neira we proceeded on the following afternoon to Aranzazu, a distance of some 20 kilometres ; it lies slightly lower than Neira, being 1803 metres above sea-level. The municipality is a small one, the principal industry is that of coffee. There is a *trilladora* for cleaning coffee, a tannery, a sugar-mill worked by water power, and 59 others worked by animal force, which produces a total of 15,600 *arrobas* of *panela*. A factory for the manufacture of blankets from locally produced wool has recently commenced operations.

The next day we proceeded to Salamina, a distance of 30 kilometres from Aranzazu, which lies 1812 metres above sea-level. Salamina is a very important agricultural centre. It maintains three *trilladoras* for cleaning and preparing coffee ; two flour mills ; two tanneries ; also 55 sugar-cane mills which produce *panela* to the value of \$75,000 a year. It also has an electric plant ; and there are two chocolate factories worked by electric power. The area of the municipality is 450 square kilometres, it has according to the last census 20,000 inhabitants, and the average temperature is said to be about 19° C.

On November 7th we proceeded from Salamina to Pacora, arriving there at dusk. This town lies a trifle higher than Salamina, there being about 7 metres difference, the average temperature is about 18° C. It is an important town and has an electric plant, and sustains a coffee *trilladora*, a flour mill, as well as a number of sugar mills of different classes, producing a total of 34,112 *arrobas* of *panela*.



FIG. VII.—LADS WEAVING PANAMA HATS.

¹ Milligrams of potash for 1 gram of wax.

² Mad tree.

¹ Arroba = 25 lbs.

On the following day I visited Aguadas, returning the same afternoon to Pacora. Here for the first time I saw something of the panama hat industry, the making of panama hats being the principal occupation in Aguada. It is, however, a domestic industry, people of both sexes and of all ages may be seen in their houses or at the doorways engaged in weaving these popular hats. They are made from the leaves of a palm (*Carludovica spp.*), which, gathered young, are cut into thin strips and bleached. This material is brought in to the local markets of Aguadas and Pacora and sold. The country people buy and take home sufficient for the number of hats they propose to make during the week, returning the next market day with the finished article for sale. Commercial travellers visit this region from the United States to purchase these hats; there are as many as eight commercial grades made, from "ordinarios"¹ to "muy finos."² Their value had, however, gone down considerably owing to the European war.

The town of Aguadas occupies a commanding position on one of the hills of the Cordillera Central, and lies much higher than Pacora, being 2,210 metres above sea-level. It has an average temperature of 18° C., but the climate is said to be humid and unhealthy. The soil is of an impermeable clayish nature, and less fertile than the lands we had previously passed through. The municipality is the second largest of the Department in number of inhabitants; the town was founded in 1808.

The municipality of Aguadas has two flour mills, an electric coffee *trilladora*, a tannery, and forty-eight sugar-cane mills of different descriptions, which produce about 373,600 kilos of *panela*, and 6,600 kilos of sugar.

From Pacora through the Western Part of Caldas.

From Pacora we proceeded to Marmato, the route passing through very hilly country. We noticed a considerable amount of oak or *roble* in the forests of the higher parts. As we left late from Pacora we were

obliged to camp the night at San Bartolo, a little village situated on the ridge of a hill overlooking Marmato on the other side of the Cauca river. We left San Bartolo early on the following morning, and commenced the descent to the Cauca river. It was a steep descent to the valley, and a steeper ascent on the other side of the river to gain the town of Marmato, and the road was the worst we had struck in Caldas. In the valley the climate is quite tropical. One of the chief features of the vegetation in the valley is the *Cuesco* or *Corozo* palm, the kernels of which yield an oil resembling the palm oil of West Africa. We reached Marmato at about 11 o'clock in the morning, and remained the rest of that day and the next as guests of the Manager of the Marmato Gold Mines, Mr. Norman L. Jenks.

Marmato is probably the richest gold mine in the whole of Colombia. It was discovered in the 16th century by the Spaniards, and is now worked by the Colombian Mining and Exploration Company of London. It is situated at 1,560 metres above sea-level, and has an average temperature of about 22° C. There is very little activity in agriculture in the district, nearly all the population being miners.

On the morning of November 12th we bid adieu to our hospitable host, and proceeded to Riosucio. After travelling for 10 kilometres we reached the town of Supia, which lies at 1,220 metres' altitude. The average temperature here is 21° C. This municipality possesses gold and silver mines, and there are 242 sugar mills of different descriptions, principally wooden. Continuing our journey we reached Riosucio early in the afternoon, it being 15 kilometres distant from Supia.

Riosucio is situated on the river of that name, and at the foot of a hill which lies 285 metres above the level of the square. It lies at an altitude of 1,810 metres, and has an average temperature of 19° C. The river Sucio is very rich in gold; silver is also found in the district. The town possesses an electric plant, is well supplied with water, and is a very busy commercial centre.

¹ Ordinary.

² Very fine.



FIG. VIII.—A GOLD MINE AT CALDAS, LA CASCADA,



FIG. IX.—THE CAUCA RIVER AT LA VIRGINIA.

On the following day we left Riosucio at noon for Anserma. Torrential rains fell that afternoon, and we did not reach our destination till 9 p.m. Anserma has an altitude of 1,790 metres, and an average temperature of 17° C. Coffee growing is one of the most important industries of the region; the district possesses two coffee *trilladoras*, one worked by electric force and the other by water power. There are two mines in operation, and a soap factory. Also several sugar mills of different descriptions, which produce about 40,000 *cargas*¹ of *panela* a year.

Almost throughout the whole line of route, within a temperate range of climate, I noticed that *fique* was being grown to a very considerable extent. In most of the towns that we passed through the fique fibre was being converted into cordage and sacks. This is a comparatively new industry and is the result of the European war, having been brought about by the difficulty in obtaining jute bags from the foreign markets. Necessity has proved the mother of invention in this case, and it may be hoped that this important local industry will develop and not be allowed to decline. Nearly everywhere one meets with *fique* on the road as a hedge plant. Here at Anserma I observed that there was much enthusiasm in evidence, with little hand looms busy turning out sacks for the export of coffee, as if they had been accustomed to do so for many years.

On November 14th, we left at 10 a.m. for Belacazar, reaching there in the evening. We passed through a good deal of forest land this day, and I noticed that the forest of the upper reaches contained a goodly number of *Cinchona* trees, the bark of which is the source of quinine. Belacazar possesses two coffee *trilladoras*, one being situated in the town and the other in the village of La Virginia; the former is worked by electric power and the latter by steam, they have an annual capacity of 180,000 and 90,000 *arrobas* respectively. Coffee is the principal industry of this municipality, sugar cane however is grown to a considerable extent, and some attention is given to mining. Belacazar lies at 1,700 metres' altitude above sea-level, and its medium temperature is 19° C. It has an electric plant for supplying light and power.

The next day we proceeded at mid-day to the Cauca river, arriving at La Virginia at 3.30 in the afternoon. The road follows the ridge that divides the Cauca from the

Rizaralda valley and from it magnificent views of both valleys and the surrounding country are obtained. The road gradually descends until the lowland country is reached. La Virginia is a port on the Cauca river, and boats ply up and down almost daily. Here the scenery is delightful and a change to the mountainous scenes we had passed through. Tall palms are conspicuous in the forests, but still more conspicuous in the open lands which have been converted from forest to pasture, since their hardness defies the axe, and they remain consequently unfelled. Extensive areas devoted to pastures, including *guinea* and *pará* grasses, make this an important cattle district. At the junction of the Cauca and Rizaralda river lies the important hacienda of Portobello, which is the property of Don Francisco Jaramillo, and here we were kindly entertained the night.

The Southern Part of Caldas.

The following day we set out for Pereira, and crossing the river Cauca, the road ascends the mountain slope covered with virgin forest. We then passed through extensive pasture lands which had been recently established, when we gained the Cartago-Pereira road, the first really good broad road that we had come across in our travels. From here onward to Pereira it is one grand and beautiful expanse of pasture lands, and one could not help admiring the fine quality of the cattle.

The town of Pereira, which we reached on market day, is situated on the banks of the Otun river. It has an altitude above sea-level of 1,418 metres, and an average



FIG. X.—THE CAUCA RIVER.

¹ A carga is 6 arrobas or 150 lbs.

temperature of 21° C. Pereira is a very important agricultural and commercial centre, and one of the chief cattle markets of the Department.

On November 18th, we left Pereira for Salento, and reached there at dusk. This day's journey was through a most fascinating country, the route being in the direction of the Cordillera Central. Salento lies at about 1,800 metres above sea-level, it is situated on a spur of the Cordillera, and commands a wonderful view of the surrounding country, or what is known as the Hoya del Quindío, extending to the distant Cordillera Occidental. The average temperature of Salento is 14° C., and the climate is considered very healthy, and a natural sanatorium for various complaints and diseases.

The Ceroxylon Palms.

The special object of visiting Salento was to enquire into the possibility of exploiting, in a commercial way, the wax afforded by the *Ceroxylon andicola* palms. Samples of the wax had been previously forwarded to England and submitted to the Imperial Institute for analysis, with the result that commercial supplies of the wax had been requested. Accompanied by Don Carlos Marulanda and Don César López, I set out on the 19th to make an excursion up the Quindío valley. In the hacienda La Britania, the property of Señor Marulanda, as will be seen from the accompanying photograph, this

the bole is often covered with moss or lichen, which obviously renders exceedingly difficult the collection of the pure wax dust. A further difficulty is that these palms occur on different properties, and there are difficulties in the way of arranging terms or obtaining permission for collecting the wax. The means, most evident, of overcoming the first difficulty is that of felling the palm. This, however, should be prohibited by the Government in respect of palms on all Government lands, and by private owners in respect to palms on their properties, since not only would scenery of great beauty be destroyed, but also the goose that lays the golden egg. An apparatus for climbing, similar to that used for climbing telegraph poles, might be employed, and this could be made by any blacksmith. Offers for lots of many tons have been received, amounting to five hundred dollars (\$500) per ton delivered at Barranquilla; this for the wax dust. This price should prove an incentive to overcome the difficulties that oppose the collection of this product, though it is possible that now the war is over the price for waxes of this nature will drop.

The purified *Ceroxylon andicola* wax is similar in character to carnauba wax (*Copernicia cerifera*) which is obtained chiefly from Brazil, and to the candelilla wax (*Euphorbia sp.*) imported from Mexico, with the exception that its melting point is higher. Before the war these waxes were selling in the United Kingdom at from £5 to



FIG. XI.—WAX PALMS GROWING IN THE QUINDIO VALLEY.

palm occurs in great quantity, and here we were able to study the whole question.

The *Ceroxylon* palm is the tallest known—one measured by us was found to be 43 metres in length, though specimens up to 57 metres in length have been recorded. The wax is secreted on the bole or trunk of the palm, as well as on the underside of the leaves. The wax dust is scraped off from the bole, and it may be exported in this form, or melted and clarified and moulded in block form; in the latter case, however, it should not contain more than 1 per cent. of water.

There are difficulties in the way of the collection of this wax on a commercial scale. The principal one is the height of the palm, and the lack of a suitable means for ascending it and collecting the wax. Another is that

£9 per cwt. The melting point of the *Ceroxylon* wax is 93° C. as compared with 84° C. for carnauba wax and 70° to 72° C. for candelilla wax. For further particulars regarding the composition of this wax reference may be made to the *Revista Agrícola*, of June, 1918—a monthly publication of the Ministry of Agriculture and Commerce, or to the *Bulletin of the Imperial Institute*, Vol. xv., p. 182.

On the Cordillera Central there appears to be two distinct species of *Ceroxylon*. The *C. andicola*, which is the common one, and another which is dwarfer; the latter has the concentric rings around the bole closer and more irregular, the fronds more outspreading, and the wax coating on the underside of the leaves browner in colour. The latter more usually affects the higher altitudes. The *andicola* is also of less economic importance from the point

of view of wax production. The *Ceroxylon*, which grows on the Sierra Nevada of Santa Marta, is quite distinct from the species on the Cordillera Central, having a much more slender bole. One of the most beautiful sights on this Cordillera is that of a *Ceroxylon* palm in fruit. It produces large hanging racemes of brilliant scarlet fruits which, in striking contrast to its white trunk, makes an impressive sight.



FIG. XII.—THE WAX PALM (*Ceroxylon andicola*).

Quiteria. (*Spigelia, pedunculata*, H. B. et K.)

My attention was drawn here, as well as in other parts of Caldas, to a root employed locally as a vermifuge. It is in great repute with the medical profession in the Department, and is preferred to other vermifuges in most cases. Samples of the root and botanical material have been sent to London for technical investigation and analysis, to ascertain if it may be of any value as a drug for export.

On November 20th we continued our journey and arrived at Armenia in the afternoon. The township is situated on a small plain at the foot of Corocito Hill. It lies at about 1,550 metres above sea-level and has an average temperature of 19°C. The municipality covers an area of about 312 square kilometres of excellent agricultural lands, the greater part being *tierra tem plada*.¹

¹ Temperate zone.

Coffee, tobacco and sugar-cane are the principal cultivations; a considerable area is devoted to imported pastures for cattle raising. Armenia has two *trilladoras*, having a capacity of 28,000 *arrobos*; there are also two chocolate factories and about 60 sugar-cane mills of various descriptions producing in the aggregate 75,000 *arrobos* of *panela*. It has also an aqueduct, which has three falls, from which almost unlimited force could be generated; this is considered one of the finest public works of the Department. Besides the above there is an electric plant.

On the 22nd I visited Calarca, a town adjacent to Anserma, situated at the very base of the Cordillera Central on the road to Ibaguë. There is operating in Calarca a coffee-cleaning mill, two tanneries, a chocolate factory and 62 sugar-cane mills of different descriptions which produce about 162,000 *arrobos* of sugar in the year.

The Quindio.

From Calarca I proceeded to ascend the Quindio along the Ibaguë road. The lower slopes are composed of fertile land, and here one meets with extensive cultivations of coffee, sugar-cane, maize and yuca. This is followed by forest land, where cedar and other valuable timber trees are found. In the middle reaches of the Cordillera, pine (*Juniperus*) and *chaquero* (*Podocarpus*) occur; also oak or *roble*, the latter increasing in quantity until in the upper-central zone the forests are almost exclusively of oak, which laden with the grey *Uanea* lichen gives a somewhat sad aspect to the scenery. When the limit of the oak forest is reached, *ensenilla* appears; there are two species of *ensenilla* (*Weinmannia* spp.), the bark of both kinds is valued for tanning purposes. Another interesting tree in this region, and which is very abundant, is the *palo de aji*, otherwise known as *Drimys granatensis*. This tree affords a bark similar to the Winter's Bark of commerce, noted for its tonic and stimulant properties. At the very top of the Cordillera a species of guava (*Psidium*) is one of the common trees.

Near the summit of the Cordillera is the divisory line between the Departments of Caldas and Tolima. The highest point of the Cordillera is approximately 3,400 metres above sea-level. From here we descended the Tolima or eastern slope of the Cordillera via La Lora to Perales, which lies at about 2,650 metres according to my aneroid. Here I was the guest of Mr. Lloyd Owen, the manager of the Quindio Mercury Mines, Ltd.



FIG. XIII.—QUINDIO MERCURY MINES.

Quindio Mercury Mines.

In the morning we left early to visit the mine, which is situated near the ridge of the Cordillera, on its eastern slope, at an altitude of about 3,350 metres above sea-level. The mine is located in the centre of an immense forest, as the accompanying photograph shows. Here occur large deposits of low-grade cinnabar-bearing schists, which crop up to the surface; these schists are being crushed and concentrated by a modern mill and mercury obtained from these concentrates by retorts. This property is being operated by an English company.

The upper zone in which this mine is situated is almost entirely composed of *ensenillo* trees, which, as I have before mentioned afford valuable tanning bark; the wood, however, burns very freely in its freshly cut green state, a useful quality in these humid rain forests.

In the afternoon we retraced our steps to Perales down the corduroy trail, and I left at five the next morning to return to Armenia; owing, however, to heavy rains, and the bad state of the road, I did not reach there till late in the evening.

Armenia to Cartago.

On November 25th we proceeded to Cartago. Leaving the picturesque Quindio river on the left, we passed through excellent agricultural lands, more or less level in nature for the first part, later changing into rolling hills, around which the road winds interminably. One of the features of the landscape in this day's journey is the abundance of bamboo; a useful plant since nearly all the houses or ranches in this region are constructed almost entirely of it, including the roof, for the bamboo in its half section makes very serviceable tiles.

These lands struck me as being especially suitable for tobacco, but I noticed that the variety in cultivation is one that grows very rank and has very little aroma. With the introduction of seed of suitable varieties, and the subsequent careful selection of seed by the planters, as well as care in the curing of the leaf, this industry might be placed on a most lucrative footing. The cultivation of tobacco, however, is a very special subject, and those desirous of engaging in it on a commercial basis would be well advised to secure the services of an experienced tobacco planter, should it be desired to avoid failure. The land and climate are admirably adapted to the cultivation of a really good tobacco, and there is no reason why tobacco equal to that produced in Jamaica should not be grown in this region, but it should be emphasized that it is necessary to give special attention to the selection of the seed, the planting, and to the curing of the leaf.

In this day's journey we observed important and extensive areas devoted to sugar-cane, maize and pastures. In the evening we reached and stayed at the village La Balsa.

The following day we left early, and at 9 a.m. reached the river La Vieja at the bridge known as Piedra de Moler. Ascending the hill on the opposite side we obtained an excellent view of the Cauca valley, in which is situated the ancient town of Cartago, and a further hour's journey in the descent brought us to the town itself.

Area, Population, and Impressions of Caldas.

Having thus terminated a round trip through the greater part of the Department of Caldas, it may be appropriate here to give briefly some of the impressions formed.

The Department comprises some 14,000 square kilometres in area. In climate it comprises all intermediate grades between tropical and cold, which for general classification may be divided into (1) tropical, (2) sub-tropical, or *templada*, and (3) cold. The greater area of

the Department is comprised within the *templada* and cold zones; a climate therefore admirably suited for the most part to the white race, which is the predominating element of the existing population. In the provinces bordering on the Magdalena and Cauca rivers, as well as in the mining districts of Marmato and Supia, the black race is represented; while in the district of Riosucio there are also inhabitants of the Indian race.

Statistics of the population of Caldas (census taken October, 1918) forms Appendix 1; from this it will be seen that the Department has a total population of 401,061. This is an increase of 59,863 since the last census was taken in 1912, and amounts to approximately 29 persons to the square kilometre, an increase in the last seven years of 5 persons to the kilometre, a very satisfactory rate.

The Department of Caldas is an important and progressive section of the country, and it possesses natural elements essential to the continued development and progress of the country. It owns the richest gold mines in the country, and possesses mineral resources as yet practically untouched, including coal.

It comprises extensive areas suitable for agricultural pursuits, for coffee, sugar, maize, cacao, tobacco, cotton, beans, rice, potatoes, wheat, barley, &c., &c. There are further great possibilities for extending pastoral lands and for developing the cattle industry and also sheep farming. The Department should have a competent veterinary surgeon, who could not only deal with the diseases of the cattle, but also be able to advise the cattle owners as to the best means of improving the race and increasing their herds.

There are extensive areas suitable for sheep farming in the mountainous regions, yet little or no attention is given to this subject. This is partly because mutton is not a favourite meat with the country people, and partly because of the losses inflicted occasionally by wild animals, especially the puma. With, however, local markets established for wool, a considerable expansion in sheep farming might be expected, but good breeding stock should be imported.

Coffee is the backbone of the commerce of the Department, the quality produced is excellent, but there is generally a want of thoroughness in the cultivation that should be remedied; the same, however, might be said of other cultivations also. With these brief reflections on Caldas, I will pass on to the Department of El Valle, and leave my recommendations respecting the measures which might be adopted for the encouragement and development of agriculture to the concluding part of this report.

DEPARTMENT OF EL VALLE.

Cartago.

At Cartago I was detained three weeks, owing to an injured leg, sustained in an accident while descending the Quindio. Cartago is the capital of the province of the same name. It is an ancient town, originally founded in 1540 on the Otun river, but subsequently transferred to its present site on the La Vieja river. The municipality has a population of 21,470, and is an important centre for the production of cacao, *panela*, coffee, tobacco, and also for cattle farming. It is a busy commercial centre and has steamer communication with Cali, the town being connected with the river port Fresno by an excellent cart road. If in respect to El Valle less statistics are given in this report, it is because that less attention has been given to the subject by the departmental Government and its Municipalities.

At Cartago our mission had been joined by two agricultural students from Bogotá, Señores Rafael Lema and

Delfin Sandobal. They arrived at Cartago while I was indisposed, and in order that their time should not be lost, I arranged for them to make an excursion along the Cordillera Occidental overland to Cali, to make scientific collections from that region.

Cartago to Cali by Steamer.

From Cartago we proceeded up the Cauca river to Cali on December 17th. We were fortunate in meeting on board the Governor of the Department, Dr. Ignacio Rengifo, who was very helpful in his advice as to our route and in relationing us with the various officials of the Department. We sailed from Fresno at five in the evening and continued until 10 p.m., when we reached the river port for Toro, where we remained the night.

The first thing that strikes one who has travelled up and down the Magdalena river, is the complete difference in the river scenery. There is, for example, an entire absence of the extensive forests which characterise the Lower Magdalena valley, and replacing them are extensive pasture lands, broken here and there by large cacao plantations, the existence of which can be observed for a long distance at this season (December) by the flaming scarlet blossom of the shade trees (*Erythrina* spp.).



FIG. XIV.—CACAO PLANTATION ON THE UPPER CAUCA RIVER.

The river at this time of the year is low, navigation having at times to be suspended. The Cauca, unlike the Magdalena, is confined within narrow banks, and the number and variety of palms, together with graceful bamboos, distributed on either side, lends a beauty to the landscape which probably does not find a parallel in any other part of Colombia.

The next morning the boat continued its upward course at an early hour, and as the heat of the day became more pronounced, large herds of cattle made their way to the river, where on the sand-banks and in the shallow parts they sought its coolness.

Pará grass is one of the principal pastures of the Cauca valley, and there is no doubt that it is one of the most appropriate to the conditions which exist in the valley, especially in areas such as those traversed by the river which are subject to periodic inundation.

One of the plants which stands out conspicuous on the river banks, as if it were there especially to announce to the passengers who pass up and down the river the fertility of the lands, is the *caña brava*.¹ This plant

¹ A grass resembling sugar-cane.

reminds one of the elephant grass of Central Africa, a plant three to four metres in height and with caulms resembling slender bamboos, which grow in such density that it is only penetrable after elephants have opened up a pathway. In Africa the elephant grass is a recognised sign of the fertility of the land on which it grows, and it would seem that the existence of the *caña brava* is no less a sign of fertility than its African congener.

The Coconut palm occurs at intervals all along the Cauca river. I noticed that these palms were bearing very heavily, carrying huge bunches of golden nuts. So prolific did these palms seem to me that it would appear that plantations on a commercial scale would prove a profitable undertaking in the valley.

From noon on the second day's journey, the river winds around the hill ranges of the Cordillera Occidental, and here and there widens out, presenting more difficulty in navigation. With the formation of sand-banks, the character of the vegetation changes, the pale green willow comes more into evidence, contrasting strikingly with the deeper green of other vegetation.

On the third day's journey bird life became more common, and we saw the swarms of ducks, beautiful pink-coloured flamingos and innumerable cormorants, kingfishers, etc. The course brought us close at times to the Cordillera Occidental, which we observed is much more arid than the opposite Cordillera, which we had recently left. Here our vision of pasture lands was widened, and as far as we could see there was little, at times, to break the expanses of *pará* grass, with immense herds of sleek cattle grazing therein. Here and there extensive plantations of cacao line the banks, and the little trees laden with their purple fruits, under their canopy of shade, form a pleasing sight.

The steamers of the Cauca river are smaller than those of the Magdalena, they are, however, modern in construction and very comfortably arranged for passengers; the menu is ample and good and

the attention on board all that one would desire.

Before reaching Cali we passed the famous drawbridge over the Cauca, on which passes the line from Cali to Palmira; this is the only bridge of its nature in the country.

The fourth day's journey brought us to the port of Cali, and a smoky old steam tram took us up to the heart of the city.

Cali.

Cali is the capital of the province of that name and of the Department of El Valle. It is situated on the Cali river at 1,042 metres above sea-level, and has an average temperature of 25° C. The population according to the last census (1918) numbers 45,524, the city was founded in 1535. It is a busy commercial centre and there are important manufacturing concerns. In the adjacent Cordillera Occidental there are extensive deposits of coal of excellent quality, which are only worked to a small extent, chiefly for supplying the needs of the Pacific Railway. The city possesses a beautiful cathedral, public and private buildings, including a magnificent theatre now

being built, public gardens, and excellent motor roads. It is also well supplied with water, and has an important electric plant.

Cali to the Pacific Coast.

From Cali we proceeded on December 27th to La Cumbre and Buenaventura by the Pacific Railway. After crossing the valley, the line soon commences its ascent of the Cordillera Occidental, winding its course up the mountain range, from which one gets a magnificent view of the valley and the Cauca river and of the towns that nestle at its base. The vegetation is scanty, but as the ascent continues the vegetation becomes more abundant and luxuriant until La Cumbre is reached, when the evidence of nature is sufficient to convince one of the fertility of the soil and of the salubrity of the climate.

La Cumbre was at one time the railway headquarters, but it is now rapidly developing into a little town where the residents of Cali and Buenaventura come to *veranear*.¹ Recreation trains are run from Cali on Sundays. It is *tierra templada*, or coffee country, and already one can see the work of the axe going on all around in its conversion from forest to agricultural lands. The forest edge, marked to-day by fields of maize or pastures, will next year recede still further; and so, each year, until the virgin forest has been entirely wiped out and converted into rolling agricultural lands.

In these forests one of the principal outstanding trees is the otobo (*Myrsine Obo*), to which I have referred in an earlier part of this report. It is here so abundant, that the forests are referred to in many localities as *Olobales*.² Should the nuts or butter (*manteca*) prove to have a commercial value in foreign markets, an export product of very considerable value and importance might be worked up in this region, since it could be landed at the Pacific Coast at very little cost.

Established at La Cumbre is an up-to-date American hospital and sanatorium, owned by the eminent surgeon, Dr. E. H. Smith, and assisted by a large staff of expert trained nurses. The establishment occupies a commanding situation at La Cumbre, is comfortably furnished, and fitted throughout with the latest appliances and material in accordance with the demands of modern surgery and medicine. The building is situated in its own grounds, with a beautiful garden and an abundant water supply.

On December 30th we proceeded on our journey to Buenaventura, and at 5 p.m. our train pulled up at its terminal coast station. From La Cumbre the line traverses interesting forest scenery over the central parts of the Cordillera; here and there are broken areas of pasture lands, plantations of maize, yuca and plantains, &c. Then it commences its descent and passes through numerous tunnels, the forest giving place to open land until the base is reached, where is situated the town of Caldas on the river Dagua, and here the railway has its workshops.

From here onwards the line follows the Dagua river, changing from one side to another at intervals; at first through somewhat arid and barren lands, and later through dense forest and jungle. The beautiful scenery of the Pacific Railway is not surpassed by any other Colombian railway, not even the Girardot line. The track follows along a narrow ledge hewn out of solid rock, then an artificial embankment, then under an archway; then crossing and recrossing the Dagua river in order to negotiate the difficult valley, until finally it makes a straight dash for Buenaventura through virgin forest, crossing the final bridge that connects the mainland with the island on which the port stands.

It was in the year 1872 that the basis of the first contract was approved, and ten years later the first

section of the line between Buenaventura and Cordoba, a distance of 20 kilometres, was completed. Since that date numerous contracts for the continuance of the line have been made and broken, and so progress has been gradual and slow, though the expenditure has been heavy. On the 1st January, 1915, the line was opened up to Cali, which is 173 kilometres from Buenaventura, and it now extends to Palmira, a distance of 199 kilometres, and to the south to Guachinti. The line has had an unfortunate history, but it stands to-day as a feat of railway engineering and a credit to the present Company and its management. When its outspreading arms reach their respective objectives at Cartago and Popayan, a new era of prosperity should be established for this important region.

The Coast Forests.

The Coast forests abound in useful timbers, and is also rich in natural products such as rubber, balata, chicle, brea, mangrove bark, &c. I had hoped to make a systematic examination of the Coast and the forest, and requested authority from Bogotá for the use of one of the small steamers at the port to do so, but receiving at the same time instructions to return to Bogotá the project had to be abandoned.

On the banks of the Dagua I noticed that a rubber plantation had been made of the local rubber tree, *Castilloa elastica*, it was however, overgrown and abandoned.

The extraction of tannin from the Mangrove bark has been initiated and should prove a profitable industry, since the mangrove tree is abundant in the bays along the coast.

Brea is an interesting product; it is the Spanish name for pitch, and is probably so called because one of its principal uses at Buenaventura is for caulking boats. It has, however, no relation to pitch, and is the product of a forest bee, evidently *Melipona heideri*, being produced by the bee in hollow trunks of trees, sometimes in large blocks weighing nearly a hundred-weight. It is generally of a sulphur yellow colour, but I am told that the colour varies according to the kind of food on which the bee feeds. A sample has been sent to London for examination, and a report as to whether it may have any commercial value in Europe is expected soon.

Buenaventura.

The port, as such, leaves much to be desired. It has no wharf, and so shipping and unshipping is carried on with much difficulty. A concession has, however, recently been granted for the building of a wharf, and when this work has been accomplished the importance of the port should be enhanced considerably. This, however, should be immediately followed by the sanitation and improvement of the port. Buenaventura is important as being the cable station for the Republic. It has 8,827 inhabitants, mostly black, according to the last census.

Cali to Cartago.

On January 4th, we returned to La Cumbre and thence to Cali. After visiting several haciendas, and the part of the valley south along the railway to Guachinti, we left Cali for Palmira en route for Cartago. We left by train, as the first objective was to visit the hacienda of Dr. M. M. Rodrigues, La Herradura, which lies close to Palmira, and our train left us at the entrance to the hacienda. We spent several hours inspecting the *potreros*¹ of this extensive property and the cattle. A trial is being given to a large variety of imported pastures, though the most largely grown and appreciated is the *paslo común*, or

¹ Take a summer holiday.

² Otobo plantations.

¹ Grass fields.

natural. Dr. Rodrigues has an excellent stock of native cattle, and has imported breeding animals of the following races: Devon, Hereford, and Red Poll. From the hacienda house one gets a magnificent view of the valley, as it is situated almost midway between the two Cordilleras. After lunching at the hacienda, I left the genial company of Dr. Rodrigues and his family and rode on to Palmira.

Palmira is a large town, the municipality having some 27,032 inhabitants, and is the capital of the Province of that name. It lies at a little lower elevation than Cali. It is an important industrial and agricultural centre and produces excellent tobacco.

On January 21st we visited, by motor car, the important hacienda of El Hatice, the property of Señor Cayetane Molina. The sons of Señor Molina, Dr. Carlos Molina and Dr. Ciro Molina Garces have established a veterinary station and laboratory on the hacienda, a most important institution for that part of the valley. We spent the whole of the day riding over the estate, inspecting the *porteros* and cattle, and in the evening returned again to Palmira.

On the 22nd I visited the important sugar plantations and factory of La Manuelita, the property of Mr. Charles Eder. This is the only modern sugar mill in the Department and the second largest in the Republic. A new

The garden of La Manuelita also contains imported fruit trees and plants in great variety. A bay tree is one of the interesting trees established.

Rainfall data has been kept at La Manuelita since the year 1900, and Mr. Eder has kindly placed at my disposal a copy of the records from 1900 to 1902, and a rainfall statement for this period is attached to this report as Appendix 4. From it will be seen at a glance the monthly rainfall for the last 19 years, the average monthly rainfall for the same period, and the number of days on which rain fell.

From La Manuelita we proceeded to Buga by motor car via Corrito. This town, as the name indicates, is situated on a small hill, which lies at 933 metres above sea-level. It has 7,198 inhabitants, the greater number of which are engaged in the cattle industry, though cacao and other crops receive some attention.

Continuing our journey we passed the town of Guacarí, which lies slightly higher than Corrito, being 980 metres above sea-level. It has 7,257 inhabitants which are engaged in similar industries to the population of Corrito.

We reached Buga early in the afternoon. This is a large town of some 13,561 inhabitants; it was founded in 1575. It is noted for its temple El Milagrosa de Buga, which is famous throughout the region, and to which pilgrimages are made.

Buga is a very important agricultural centre, and in its vicinity are some of the best haciendas of the valley.

From Buga we proceeded to Bugalagrande by coach, via Tulúa. Reaching Tulúa early in the morning we visited the local market, which is one of the best in the valley and a very important one. It may be of interest to give here some of the prices of the principal produce on sale that day, January 24th; the following are per lb.: potatoes 5 cents.,¹ beans 5 cents., rice 10 cents., yuca² starch 14 cents., cacao 28 cents., coffee 12 cents., sugar 12 cents., salt 8 cents., *panela* 7 cents., cheese 16 cents., beef with bone 10 cents., beef without bone 14 cents., pork with bone 12 cents., pork without bone 15

cents., lard 40 cents., maize 80 cents. per *arroba* and plantains 40 cents. the bunch.

Cacao and tobacco are grown on a large scale in Tulúa, where considerable attention is also given to cattle farming. The population of the municipality is 15,274. Tulúa was an old Spanish town, founded in 1794 on the ruins of an old Indian settlement.

Proceeding from Tulúa we reached Bugalagrande early in the afternoon, which is a small town with a population of 6,114, and is the present terminus of the cart road from Palmira. This is, however, being extended to Cartago. The same afternoon I left for El Guavito, an important hacienda of some 7,000 *fanigadas* (11,200 acres), the property of Mr. Charles Eder. Here I had the opportunity of seeing a section of the valley from the foothills of the Cordillera Central to the river Cauca, and also of seeing further results which Mr. Eder has obtained from crossing the native cattle with the Zebu breed.

¹ The Colombian cent. is normally equivalent to the American cent. or $\frac{2}{3}$ d.

² Manioc



FIG. XV.—LA MANUELITA SUGAR FACTORY.

crusher has been recently installed capable of dealing with 18 tons of cane per hour. The establishment of this factory is an undertaking which reflects great credit on the owner, since all the machinery was brought over the Cordillera Occidental from Buenaventura before the Pacific Railway was built, a colossal work which occupied two years. The mill as equipped to-day is not altogether a model one, since it has been additioned and altered from time to time to adapt it to requirements and to such working units as could be obtained. It, however, fulfils its purpose and turns out excellent white sugar, which finds a ready market. A distillery is also attached to the factory.

The plantations of La Manuelita contain experimental fields of new and introduced varieties of cane which should prove important acquisitions to the country.

La Manuelita comprises also extensive grazing lands, and Mr. Eder has imported examples of the Indian breed of cattle, the Zebu, and obtained excellent results in crossing it with the native cattle. He has imported horses of the Cleveland Bay breed, and crossed them with the native breed with very useful results.



FIG. XVI.—EL MILAGROSA, THE CELEBRATED TEMPLE AT BUGA.

The following day I visited the estate La Paila, the property of Señores Echéverri Hermanos, which adjoins El Guavito. This hacienda comprises an extensive cacao plantation, as well as a coffee plantation and grazing lands. The cacao plantation contains about 30,000 trees, and produces a cacao of excellent quality. A sample of the beans submitted by myself to a London broker some time ago, from this estate, was pronounced to be of the finest grade and suitable for the manufacture of the best confectionery. The shade tree in use is principally the *Caracoli* (*Anacardium rhinocarpus*), which, in my opinion, gives excessive shade. The *Caracoli* grows to an immense size; it is one of the biggest trees of Colombia; it provides profuse shade and is moreover very exhaustive to the soil. It is further not a *Leguminous* tree, which is a disadvantage, as *Leguminous* trees are preferable for the beneficial action they exercise on the soil.

The same evening we rode on to Zarzál, where we arrived very late. This is a small town of some 4,221 inhabitants, who are principally engaged in the cattle industry; the town is situated in a very narrow part of the valley.

The next day's journey brought us back to Cartago, the starting point of our tour through El Valle. The inspection made of this Department was but a cursory one, having received at Buenaventura instructions to terminate the mission and return to Bogotá. I was not therefore able to give the time and attention to this important Department as I would much liked to have done. Having at Cartago reached the northern limit of El Valle, it may be fitting here to give a résumé of the impressions formed of the valley, before proceeding to recount the return journey to the Magdalena valley.

GENERAL IMPRESSIONS OF EL VALLE.

Population.

The population of the Department numbers 272,551 souls, or 128,510 less than the population of Caldas. The distribution of the population will be seen from the table

which forms Appendix 2; Cali, Palmira, Cartago, Tulúa and Buga are the most populous centres.

The area of the Department El Valle is roughly calculated at 28,000 square kilometres, or double that of Caldas: its population per square kilometre works out at a fraction less than 10 persons as compared with 29 per square kilometre in Caldas.

From cursory observation in journeying through these two Departments, it is apparent that in Caldas, although there are many large properties, land is more broken up into smaller holdings; whereas in El Valle the greater part of the land remains in large estates, and there are comparatively few small holdings. The manner in which land is held in El Valle accounts to a large extent for lesser agricultural activity and a sparser population; but the divisory line between El Valle and Caldas is also the divisory line between the races *Caucano* and *Anlioqueño*, the latter being recognised as more reproductive than its neighbour.

Fertility of El Valle.

The fertility of the Cauca valley is a much advertised and assumed point. By the Cauca valley, I refer in this case to the valley which lies between the two Cordilleras, and has its northern limit at Cartago, and in the south the limits of the Department. While I would not endorse all I have read and heard in this respect, since the northern and southern extremes of the valley possess lands of very ordinary character, there is no gainsaying the fact that the greater part of the valley, especially the alluvial lands in the region of the Cauca river and its tributaries, are of excellent quality. They are suitable for the production of a great variety of crops, as well as first-class pastures for cattle raising and fattening. Taking into consideration the altitude, which averages rather under 1,000 metres above sea-level, and the excellent climate, the average temperature being about 25° C., together with the productivity of the soil, it may be difficult to find a region in other parts of Colombia superior for general tropical agriculture and cattle raising.

This area is admirably adapted to modern methods of mechanical cultivation. This is a great advantage in the production of crops on a commercial scale, and it is an important point that agricultural implements can be brought from the port of Buenaventura and distributed in the valley by rail and water. Little has, however, been yet done in this way; it is surprising to note how little use is made even of animal-drawn ploughs, especially when horses and oxen for draft purposes are abundant. A commencement has, however, been made, and one enterprising person has introduced steam tractors and other power agricultural implements for hire. Adequate preparation of the land is a necessary preliminary to the successful cultivation of crops, and is one of the elementary principles of agriculture which should be accepted and followed. I have often been told, with boastfulness, that the land had not been ploughed or broken up for this or that crop, and that it gave good returns; it is seldom considered that had the land been suitably prepared, it would have produced much better returns.

Crops suitable for El Valle.

The valley embraces lands suitable for the successful cultivation on a commercial scale of cacao, sugar-cane, tobacco, cotton, rice, maize, coconuts, beans, &c., &c. Cacao, sugar-cane, and maize are cultivated to a moderate extent, but the greater part of the valley is devoted to pastures for cattle raising. Coffee is grown in the Cordilleras to some extent.

Cacao.

Cacao was cultivated at one time to a much greater extent in the valley than it is to-day, but insect pests and

diseases have been allowed to ravage the plantations and reduce their productiveness to such an extent that large areas have been abandoned and supplemented by pastures. There is no doubt that cacao is one of the most important crops for El Valle, providing that the plantations are properly managed. From observations made in various parts of Colombia, I am firmly of opinion that the trees are not so productive as they should be owing to the damage and destruction caused by insect pests and fungoid diseases. It is no exaggeration to say that the production in many *cacaotales* is reduced from thirty to even fifty per cent., in certain cases more, from these causes. If the plantations were properly managed and the pests and diseases controlled by spraying with suitable insecticides or fungicides, the loss which is now suffered would be saved and the annual production very considerably augmented. These insect pests and diseases are not peculiar to this country, they exist also in other cacao-growing countries—for example, in the Antilles. It is generally admitted in the Antilles that if spraying and other measures are not taken systematically there is usually a loss amounting to fifty per cent. of the crop. The situation is one that calls for immediate attention, and it is my opinion that the Government of the Department should encourage and foster this most important industry by facilitating the importation of spraying machines and appliances, and by the provision and sale to the growers of suitable insecticides and fungicides at cost price and duty free. It should further provide instruction in the methods of treating these pests, preferably by way of sending around a competent agricultural instructor who should give practical demonstrations. It is sad to see *cacaotales* being abandoned to pastures; I am in favour of the expansion of the cattle industry, but there is plenty of room in the valley for pastures on lands unsuitable for cacao. The production of cacao is a staple industry of the Department, which in my opinion should not be allowed to fall into decay; the sanitation of the existing *cacaotales* is a matter, however, which calls for immediate and serious attention. It is not possible to go into details of treatment in this Report without making it too long; I hope, however, to publish shortly a pamphlet on this subject for the use of growers.

Cotton.

Cotton should prove a remunerative crop in such parts of the valley where the soil is well drained and not subject to inundations, and where labour is available in adequate quantity. There is no doubt that if cotton be produced on a large scale it would find a ready sale locally. The early ripening varieties known as American Upland should prove most suitable for the valley, sowing being made at a time to allow the crop to come to maturity in the dry season, or during the driest months of the year. The rainfall table at the end of this Report might be consulted in this connection, bearing in mind that for the first six months, during its period of growth, it requires a moderate rainfall, thereafter little or none. The plant should be treated as an annual and destroyed after gathering the crop, so as to prevent as much as possible the propagation of insect pests and diseases. The cultivation of cotton is exceedingly simple, but the plant has many insect enemies, and it is necessary that the grower should be acquainted with the methods of controlling them before embarking on its cultivation on a large scale. With the view to encouraging the cultivation of cotton in the Department, I would recommend that the local Government should import a quantity of seed of a few of the best strains of Egyptian and American Upland, and distribute them amongst would-be growers for trial, keeping the varieties to distinct regions to prevent mixture of

the staple. Trial should also be given to the excellent Lengupa cotton of Boyacá, which is infinitely superior to the American Upland types, and would fetch double the price. It might also import sprayers and insecticides, so as to have at hand remedies for such insects as may appear; such insecticides and apparatus for applying them might be supplied to the growers at cost price, in order to encourage the initiation of this industry. These remarks and recommendations not only apply to the Cauca Valley, but are also applicable to the Hoya del Quindio and similar regions of Caldas.

Tobacco.

The valley comprises suitable lands for the cultivation of good grades of tobacco, and leaf of very fair quality is produced for local consumption, especially in Palmira and Tulúa. The cultivation and curing of this crop is a very specialised profession, and it requires experienced and trained persons to produce a first class tobacco. Persons desirous of embarking on its cultivation on a commercial scale, especially if for export purposes, would be well advised to secure an experienced grower from one of the countries where tobacco leaf of high quality is grown. Nevertheless, much might be done by the introduction of selected seed of good strains, and the careful selection of seed from year to year, only from selected plants possessing good qualities and reserved especially for the production of seed. Also by greater care in the selection and curing of the leaf. These remarks also apply to the Hoya del Quindio of Caldas.

Sugar-cane.

Many parts of the valley are suitable for the production of sugar-cane, but there exists only one estate that is producing white sugar on a commercial scale by modern methods. There are numerous cane plantations for the production of *panela*, and with its present high price, this is a most lucrative industry. Much might be done to bring about the improvement of the cane plantations in the way of increasing their producing capacity, by the careful selection of cane for planting purposes, and by the introduction of improved varieties of cane from the West Indies.

Rice.

Irrigation can be easily effected in different parts of the valley, and there are extensive areas that might be devoted to the cultivation of rice. A commencement has been made in one locality, but there is no reason why its cultivation should not be taken up more generally. Seed might be procured of some of the well-known Indian types and distributed to growers.

The Cattle Industry.

Cattle raising forms the principal occupation in the valley, and there is no doubt that it is the industry on which the future prosperity of the Department lies. The world's demand for cattle is increasing, and El Valle having a port of its own on the Pacific Coast, with a railway tapping the north and south of the Department and neighbouring provinces, the cattle industry cannot fail to grow in importance and prosper.

The local Government should however endeavour to foster and improve the industry, as the local breed of cattle forms excellent material for building up a first-class type of cattle for beef. Considering the vital importance of this industry to the country, and the necessity of improving the size and quality of the cattle, as well as increasing the herds, I would recommend that the Government should establish a small stock farm, where breeding experiments should be carried out, to prove the

most suitable breeds for crossing and developing the native type. Such a stock farm should be under the charge of an experienced stock breeder, who should also be a qualified veterinary surgeon, capable of dealing with outbreaks of disease and the ailments of cattle. It should be one of the principal objects of the stock farm to eventually furnish to farmers suitable stock animals for breeding purposes at nominal charges.

I have been frequently asked what are the best breeds to introduce for the purpose of crossing with the native stock. This is a question that can only be definitely determined by experiment carried out in defined regions, and this proof should be afforded by a stock-farm. In this connection, I would limit myself to the recommendation of breeds which should prove suitable under careful management and good conditions. Results vary in many cases according to the strain of breed imported, which often varies considerably; therefore much depends on that point. The introduction of European breeds must be attended with great care, and protection afforded against ticks and biting flies, to avoid the contraction of diseases. The acclimatization of European breeds is always attended with great risk, and breeding stock imported should always have all the care and attention possible bestowed upon them until they become thoroughly acclimatized.

For the production of beef, the Hereford breed should prove satisfactory, also the Shorthorn; though the former will thrive in poorer pasture than the latter and is more hardy. The Shorthorn, if of good strain, is excellent for beef and milk; the Hereford is very popular in the United States and in the Argentine and other parts of the world, in fact is of proved merit for regions similar to that of the Cauca valley.

For dairy purposes, crossing with the Holstein or Ayrshire breeds should have good results; the Holstein is a large and profitable breed producing good milkers, which are appreciated in many parts of the world. The Ayrshire is the famous milking breed of Scotland, where its produce is chiefly used in the manufacture of cheese; it is one of the best known breeds for the production of milk.

The Indian Zebu cattle should, in my opinion, be more appreciated in this country than they are. They have the advantage that they are hardier than the European breeds, thrive in poor pastures and mature early. It is true that they are wilder in nature and for this reason less easy to manage, but their hardiness and other qualities should recommend them, especially to those who cannot give the necessary attention and care that the acclimatization of European breeds demand. This is further an excellent race for draft animals, strong and hardy.

Pastures. Natural and Imported.

Another vexed question is that of the most suitable pasture for cattle. I have been repeatedly asked what is the best pasture or grass to grow. This is a question that cannot be answered in a general way; the hacienda, its soil and climate, must be taken into consideration, before a reply of any value can be given. The most suitable pasture is that which thrives most successfully on the land, given that it possesses satisfactory feeding value. Now, the different grasses which have been imported from foreign countries from time to time have their distinctive climates and soil conditions. A grass which may thrive in one locality and prove an excellent pasture, may be a failure in another. One learns, to a great extent from experience, which is the best pasture to grow in a certain district from the manner in which it thrives. The relative feeding value of different grasses can only be satisfactorily determined by definite experiment; by feeding animals of a similar age and condition with a given quantity of cut grass daily, weighing them periodi-

cally to note the relative development of the animals fed on the respective grasses. This is difficult to accomplish in this country in the absence of suitable weighing machines, consequently one has to rely mainly on personal judgment, which is of variable quality.

Pasto común, the native or natural grass, is composed of three or four species, and differs in its composition according to the relative proportion of the species, or the predominance of one; it is in high repute for its feeding value in El Valle. It is stated that it will stock more cattle than *pará*. Judging from the condition of cattle I have seen in this pasture, I should say that it is a very suitable pasture for lands in the valley which are not subject to inundation, but which on the other hand are not excessively dry. In Caldas *pasto común* is considered inferior to *micáy*, but this is again a question of climate, since *micáy* would be unlikely to do well in the low-lying region of the valley, being a grass more adapted to a temperate climate.

For moist land, and lands subject to periodic inundations, such as large areas are on the banks of the river Cauca and its tributaries, there is probably not a better pasture than *pará*, though it is not so suitable for horses as for cattle.

The grass known as *janeiro*, which is comparatively new to this region, is one that grows vigorously in El Valle, and should prove a suitable pasture. It is of spreading habit and rapidly covers the ground, a feature which should necessitate less cleaning.

The *guinea* grass is suitable rather for more friable lands and lands of granitic origin. It is an excellent pasture for the fattening of cattle, as has been abundantly proved in different parts of Colombia.

Yaraguá is a grass which is repugnant to ticks, and it is said also to be repugnant to warble larvæ (*mucho*) and so keeps the cattle free from that pest. The grass contains an oil, to which is due its disagreeable odour, no doubt unpleasant to insects such as ticks and *mucho* larvæ. This grass might be more extensively grown in districts where these pests are abundant.

Use of Lime.

I noted that no attention is given to the use of lime for agricultural purposes. Application of lime to soils which are deficient in that substance would prove of great advantage; especially is this so in regard to the high lands of Caldas. Lime is not a fertiliser in the ordinary sense, it is a corrective, and its great value for agricultural purposes should be better appreciated. The high cost of lime, however, in these Departments prohibits its use for agricultural purposes. If private enterprise cannot produce lime at a reasonable rate, the Government might consider the advisability of running lime kilns at different centres and of selling the lime to farmers at cost price.

Secciones Agrícolas.

I have given a good deal of thought and careful study to the question of the best means to adopt to encourage the development of agriculture in the different Departments of the Republic, and I have come to the conclusion that the best way to attain this end is by the establishment and organization of an efficiently-equipped *Sección Agrícola* under the Administration of each Department.

Such a *Sección*, or Department of Agriculture, should be manned by a competent *Agrónomo* and an Assistant *Agrónomo*, with the necessary clerical assistance. The *Sección* should have an office at the capital of the Department, where the chief of the *Sección* should reside and attend to the routine work of such an office. Part of his duties should be that of the collection of agricultural

statistics, the issue of circulars on the cultivation of crops, supply of seeds to farmers, consultations, &c., &c.

The *Sección* should maintain close touch with the Ministry of Agriculture and Commerce, and agricultural data should be collected and tabulated according to a definite and uniform plan in all the Departments, so that it may prove useful for the compilation of the *Carta Agrícola* of the country.

The special duties of the Assistant should be to tour the Department as travelling Agricultural Instructor, advising the farmers on all questions pertaining to the cultivation of their crops, &c.

Attached to the Capital might be an experimental station, where experiments should be made with new or little known crops, and where modern methods of cultivation might be demonstrated. Such establishments should also produce seed for distribution to farmers.

This idea might be carried further, and a small experimental and demonstration farm established at the principal municipalities, so that the country people who flock to the weekly markets might visit these experimental fields and carry back with them useful ideas and impressions. Such experimental fields should be maintained by the municipalities, whilst the Gobernación or Departmental Government, in order to stimulate and promote competition, might offer prizes annually to the best and most efficiently maintained station.

There is I find, among a certain class of youth in this country, a growing distaste of all that savours of agriculture which is to be deplored. This tendency is not confined to this country, it is found in other parts. With the object of remedying this, elementary agricultural education should be taught in the schools, and school gardens established where the practice of agriculture may be taught to the boys. The principles of agriculture should be instilled in the young minds in an instructive and attractive manner calculated to create a love for the profession. Agricultural education in the schools, and the establishment of school gardens, have done excellent work in other countries, and there is no reason why useful work should not be accomplished in this country in a similar way. A part of the municipal farm or garden might be placed at the disposal of the municipal schools.

The organization of these experimental fields should be under the direction of the *Sección Agrícola*, and the Travelling Agricultural Instructor should give practical assistance in their organization and maintenance.

To the *Sección Agrícola* should be attached a Veterinary Surgeon, if the Department is important from a cattle point of view, and in the case of such Departments as El Valle, a stock farm, as I have before indicated.

Such *Secciones Agrícolas* should, in my opinion, be commenced in a modest way in accordance with the funds which the Department can afford to devote to the service. The *Secciones* might be started with an annual provision of from \$10,000 to \$20,000, according as to whether it included a stock farm with a Veterinary Surgeon or not.

The formation of such a *Sección* as part of the administration of the *Gobernación*, with the staff indicated, and with financial provision for affording assistance to the farming community in the manner that I have outlined in this report, should do much to place the agricultural and cattle industries on a progressive and prosperous footing.

The Return Journey from Cartago.

We left Cartago on our return journey on January 28th, taking the route *via* Pereira, Manizales and Mariquita.

Leaving the river La Vieja behind, one immediately commences to climb to regain the highlands of Caldas.

We passed the initial kilometres of the new railway line in construction, the Caldas Railway, destined to connect Cartago with Manizales. Here we found the country more densely settled, and the contrast with El Valle in this respect at once demonstrated. We reached Pereira in the afternoon, which town, as I have before mentioned, has an altitude of 1,418 metres above sea-level.

From Pereira we proceeded to Santa Rosa de Cabal, a distance of 12 kilometres. This town was founded in 1844. It lies at an altitude higher than Pereira, being 1,697 metres above sea-level, and its average temperature is 18° C. Its population numbers 20,017. The principal industries are cattle, coffee and cane, but attention is also given in this district to panama hat making. There are three *trilladoras* for cleaning coffee, and there is an electric light plant which provides light at the cheap rate of 10 centavos (5d.) per lamp. There are also gold and silver mines. The Caldas Railway is projected to pass Santa Rosa de Cabal, which should eventually assist much in the development of trade and commerce with this progressive and important centre.

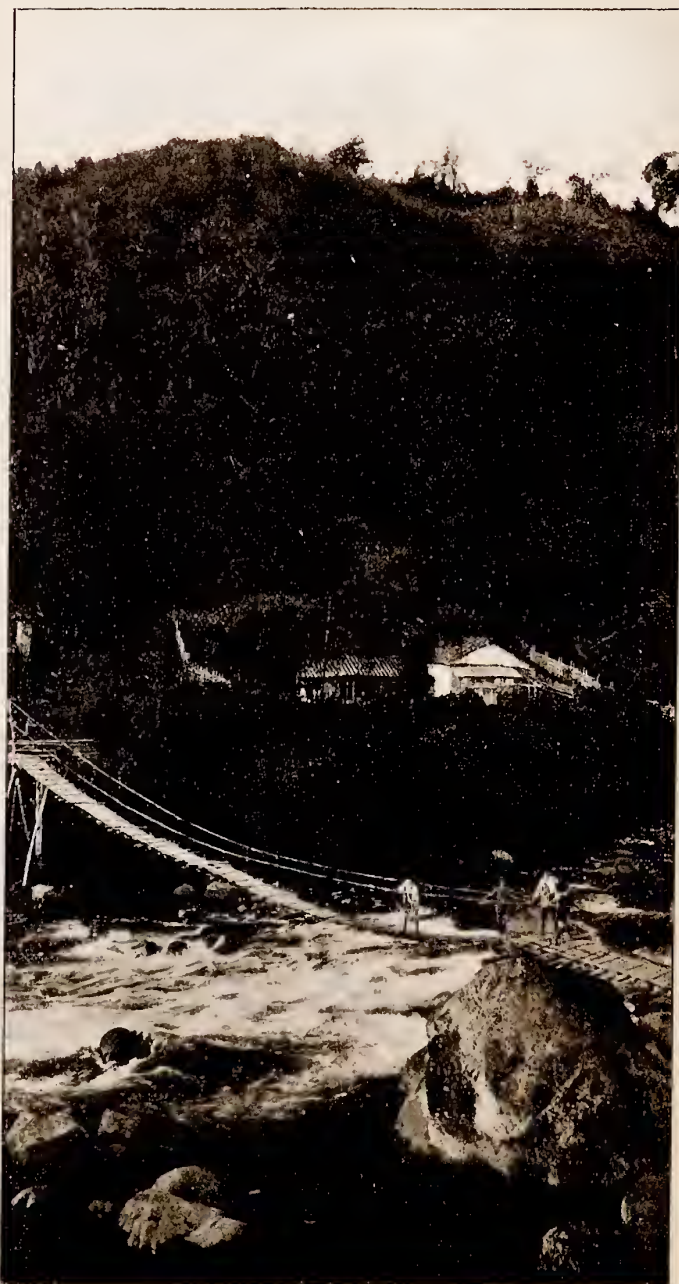


FIG. XVII.—A WOOD SUSPENSION BRIDGE NEAR PEREIRA.



FIG. XVIII.—A *Trilladora* OR COFFEE-CLEANING MILL IN CALDAS.

The next day we continued our journey and at 12 kilometres distance we arrived at the town of San Francisco, a town founded in 1844. It lies at 1380 metres above sea-level and has an average temperature of 22° C. It has 6,650 inhabitants, which are principally engaged in cattle farming, coffee and cane growing. A considerable quantity of maize is also grown, as well as beans and vegetables for the Manizales market. We continued our journey after lunch to Manizales, and after several hours spent in climbing the hillside under a burning sun, we reached our destination.

From Manizales we proceeded the next morning to make our third crossing of the Cordillera Central, on our way to the Magdalena valley; and after leaving the beautiful plateau of Manizales we commenced the ascent of the western slopes. I found the *páramos* less interesting, and the lands poorer, than the Ruiz and Quindío trails, though there were many interesting plants on these *páramos* that I had not previously collected. After riding from Manizales, a distance of some 36 kilometres, we came to a *posada* situated in a bleak position known as Letras, where we passed the night in company with many *arrearos*.

Continuing our journey the next morning we soon commenced the descent down the eastern slopes of the Cordillera, and early in the morning came to the advance works of the Mariquita-Manizales cable-way, and later in the morning to the Station of Frutillo, from which this transport cable now operates with Mariquita. At about 25 kilometres from Letras we reached Solidaridad, a small town on the Cordillera situated in the Department of Tolima. After lunching here we proceeded a further distance of 18 kilometres, when we reached a small village known as Aguacatal, where we camped the night.

Continuing our descent early we reached at about 11 in the morning the small and picturesque town of Fresno, a busy little centre for coffee. In the afternoon we proceeded, and at about 12 kilometres from Fresno we reached the gold mines known as La Parroquia, and pushing on we arrived at Mariquita just in time to hear the whistle of the 6 o'clock train arriving from Honda.

The next morning we proceeded to the Estación Agronomica Tropical at San Lorenzo by train on the La Dorada Railway. After there disposing of our collection, we left for Bogotá. Finding the navigation of the Upper Magdalena suspended, we made the journey from Boltrán to Girardot by canoe, the trip occupying two days and three nights almost continuous travelling, arriving at Girardot just in time to catch the 7 a.m. train to the capital.

Of the botanical collections made on the journey, a set has been placed in the herbarium at the Estación Agronomica Tropical, a further set has been forwarded to the Royal Botanic Gardens, Kew; and a third set has been sent to the New York Botanical Gardens of the United States. A scientific paper on these collections will be prepared and published at a later date.

A sketch map is attached to this report showing the route followed.

In concluding this report I desire to express my grateful thanks to the officials and others who have rendered me assistance in this mission, and especially to my companion and secretary, Don Pablo Aza, whose devotion to the objects of the mission made my task less difficult.

BOGOTÁ,

March 26th, 1919.

APPENDIX I. (See p. 15.)

CENSUS OF INHABITANTS OF THE DEPARTMENT OF CALDAS, TAKEN OCTOBER, 1918.

PROVINCE.	MUNICIPALITY.	
Manizales -	Manizales -	41,146
	Villa Maria -	8,038
	Neira -	12,598
	Filadelfia -	5,844
	Palestina -	5,436
	San Francisco -	6,650— 79,712
Salamina -	Salamina -	19,358
	Aguadas -	26,390
	Pacora -	13,061
	Aranzazu -	8,294— 67,103
Manzanares -	Manzanares -	13,363
	Pensilvania -	12,974
	Marulanda -	4,452
	San Agustín -	7,563
	Victoria -	4,576— 42,928
Pereira -	Pereira -	23,557
	Sta. Rosa de Cabal -	20,017
	Marsella -	8,757
	Filandia -	5,844
	Montenegro -	5,014
	Armenia -	16,578
	Calarca -	18,365
	Circasia -	6,783
	Salento -	4,217—109,133
Riosucio -	Riosucio -	18,125
	Marmato -	5,120
	Supia -	6,140
	Anserma -	15,868
	Belacazar -	8,547
	Apia -	10,599
	Santuario -	11,280
	Bolen de Um. -	9,379
	Nazareth -	6,964
	Pueblo Rico -	3,444
	San Joaquin -	6,719—102,185
Total population of Caldas -		401,061

APPENDIX II. (See p. 19.)

CENSUS OF INHABITANTS OF THE DEPARTMENT EL VALLE, TAKEN OCTOBER, 1918.

PROVINCE.	MUNICIPALITY.	
Cali -	Cali -	45,524
	Jumbo -	3,563
	Vides -	3,612
	Pavas -	4,811
	Caldas -	6,847
	Jamundi -	7,022— 71,379
Buenaventura -	Buenaventura -	8,827
	Naya -	3,365— 12,192
Palmira -	Palmira -	27,032
	Candelaria -	11,248
	Florida -	5,092
	Pradera -	6,064— 49,436

APPENDIX II.—continued.

Buga -	Buga -	13,561
	Cerrito -	7,198
	Guacarí -	7,257
	Yocoto -	5,922
	San Pedro -	3,281— 37,21
Tulúa -	Tulúa -	15,274
	San Vicente -	5,263
	Bugalagrande -	6,114
	Zarzal -	4,221
	Sevilla -	11,647— 42,519
Rodanillo -	Rodanillo -	9,197
	Bolívar -	5,649
	Huasano -	3,249
	La Unión -	3,984
	Versalles -	5,768
	Toro -	4,433— 32,280
Cartago -	Cartago -	21,470
	La Victoria -	6,056— 27,526
Total population of El Valle -		272,551

APPENDIX III. (See p. 17.)

IMPORTS AND EXPORTS FROM BUENAVENTURA.

			IMPORTS.		
			Kilos		Value \$
Year					
1913	...	...	12,416,344	...	2,963,809
1914	...	...	16,664,977	...	2,824,947
1915	...	...	14,161,420	...	2,037,398
1916	...	...	12,284,732	...	2,971,093
1917	...	...	10,715,662	...	2,486,820
1918.	January	...	486,685	...	171,655
	February	...	676,027	...	182,698
	March...	...	365,649	...	131,573
	April ...	...	572,809	...	153,931
	May ...	...	592,041	...	107,497
	June ...	...	1,091,993	...	421,168
	July ...	...	952,519	...	278,076
	August...	...	396,035	...	79,483
	September	...	410,084	...	97,404

			EXPORTS.		
			Kilos		Value \$
Year					
1913	...	...	5,739,732	...	2,252,314
1914	...	...	6,844,190	...	2,220,177
1915	...	...	6,814,905	...	2,375,611
1916	...	...	9,747,699	...	3,370,013
1917	...	...	14,452,122	...	4,741,680
1918.	January	...	1,422,909	...	476,675
	February	...	1,209,699	...	408,954
	March...	...	1,725,512	...	568,500
	April ...	...	1,572,402	...	446,831
	May ...	...	1,656,453	...	539,337
	June ...	...	572,080	...	232,296
	July ...	...	1,606,373	...	466,606
	August...	...	573,398	...	315,522
	September	...	160,080	...	118,463

The Colombian \$ at normal times is about equal to the American \$.

APPENDIX IV.

RAINFALL STATISTICS AT LA MANUELITA, EL VALLE.

APPENDIX

RAINFALL STATISTICS TAKEN

	1900 inches	1901 inches	1902 inches	1903 inches	1904 inches	1905 inches	1906 inches	1907 inches	1908 inches
January . .	—	1·86 (6)	4·14(20)	5·56(15)	2·69(15)	2·62 (7)	2·05 (3)	1·74(10)	5·02(10)
February . .	0·47	2·26(13)	3·03(18)	2·74 (+)	3·97(15)	0·67 (+)	3·99(14)	2·40 (9)	3·75 (9)
March . .	5·41(10)	4·98(10)	6·03(17)	2·07 (6)	3·56(14)	1·80 (3)	3·11(11)	4·77(23)	4·97(14)
April . . .	4·69(11)	2·52 (9)	3·98(16)	7·21(16)	8·80(16)	3·56(10)	4·68(16)	7·20(20)	8·72(23)
May . . .	4·30(16)	7·52(17)	2·78(15)	8·06(11)	6·27(19)	4·53(10)	4·05(17)	6·57(11)	3·63(20)
June . . .	5·66(10)	3·31(11)	1·38(10)	6·05 (6)	0·86(11)	1·31 (8)	4·15(11)	3·73(12)	0·32 (6)
July . . .	1·42 (9)	2·51(13)	0·65 (7)	2·46 (6)	1·12(10)	0·05 (2)	0·67 (2)	2·29 (7)	1·47(10)
August . .	0·45 (8)	3·47(12)	1·37 (8)	2·17(10)	0·23 (6)	0·46 (6)	1·26 (7)	0·76 (5)	1·60(11)
September .	3·35(15)	4·01(12)	1·91(11)	2·72(10)	1·90 (9)	3·74(17)	3·56 (9)	3·06 (8)	8·47(12)
October . .	4·79(20)	7·23(16)	2·22 (6)	5·22(12)	2·75 (9)	5·77(20)	3·19 (7)	8·35(16)	10·66(26)
November .	5·64(14)	3·41 (9)	4·84(10)	3·99(18)	4·14(12)	6·29(16)	4·50(11)	4·93(15)	6·13(22)
December .	1·79(10)	2·13 (8)	1·47(10)	8·13(17)	1·45 (5)	2·99(10)	6·75(18)	2·80 (8)	5·20(14)
Total fall . .	37·97	45·21	33·80	56·38	37·74	33·79	41·96	47·80	54·94
Total days .	123	136	148	131	141	113	126	144	177

NOTE.—The figures in brackets indicate.

IV. (See p. 18.)

AT LA MANUELITA, EL VALLE.

1909 inches	1910 inches	1911 inches	1912 inches	1913 inches	1914 inches	1915 inches	1916 inches	1917 inches	1918 inches	average
3.05 (9)	4.63(13)	1.05 (8)	2.12 (6)	3.69(17)	2.18 (8)	2.73(10)	3.48(12)	4.62(16)	2.29(12)	3.08
7.75(15)	6.20(12)	6.23(16)	1.34 (7)	1.81(11)	1.65 (4)	4.66(12)	6.71(12)	4.25(21)	2.84(15)	3.51
4.87(14)	4.97(15)	3.29(13)	3.95(14)	2.14(11)	0.64 (4)	3.74 (8)	10.07(16)	1.91(10)	6.99(19)	4.17
9.58(18)	7.16(13)	9.46(20)	5.47(16)	9.68(18)	6.29(13)	6.54(16)	6.12 (9)	6.16(19)	3.93(15)	6.47
6.21(25)	5.73(15)	7.87(17)	4.33 (9)	6.57(17)	2.42(14)	2.34(13)	2.80(11)	7.21(20)	5.53(18)	5.17
3.05(19)	2.08 (8)	1.68 (6)	1.87(10)	2.25 (9)	1.20 (7)	3.14(13)	3.49(13)	1.40(10)	1.37 (8)	2.51
2.25(13)	2.80(12)	0.43 (1)	1.72 (5)	0.64 (6)	0.37 (1)	3.36(13)	3.78(12)	1.81(16)	0.43 (6)	1.53
3.10(12)	0.90(10)	0.48 (4)	1.88 (9)	2.14 (9)	0.23 (3)	1.74 (9)	2.31(11)	2.12(12)	1.68 (7)	1.49
2.13 (9)	1.45(14)	0.12 (1)	2.05 (8)	3.84(12)	2.04 (6)	2.58(10)	2.32(10)	4.62(17)	1.03 (7)	2.63
7.94(18)	4.36(18)	5.71(12)	6.73(16)	7.26(11)	5.07(11)	8.31(17)	8.40(25)	3.20(17)	5.10(15)	5.91
3.91(14)	3.50(15)	4.77(13)	3.85(14)	7.57(18)	1.63(15)	5.76(12)	7.38(26)	4.79(22)	5.98(19)	4.68
1.32 (6)	4.75(15)	3.10(11)	5.97(14)	2.32 (8)	7.35(12)	0.64 (6)	1.74(13)	5.78(21)	1.38 (5)	3.42
55.16	48.53	44.19	41.28	49.91	31.07	45.54	58.60	47.87	38.55	44.57
172	160	122	128	147	98	139	170	201	146	

the number of days on which rain fell.

